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INTERNATIONAL APPLICATION PUBLISHED UNDER THE PATENT COOPERATION TREATY (PCT)

(51) International Patent Classification 6 : B41J 2/21, 25/34, 2/05

A1

(11) International Publication Number: **WO 96/34763**

(43) International Publication Date: 7 November 1996 (07.11.96)

(21) International Application Number: PCT/US96/06168

(22) International Filing Date: 2 May 1996 (02.05.96)

(30) Priority Data:
08/433,295 3 May 1995 (03.05.95) US

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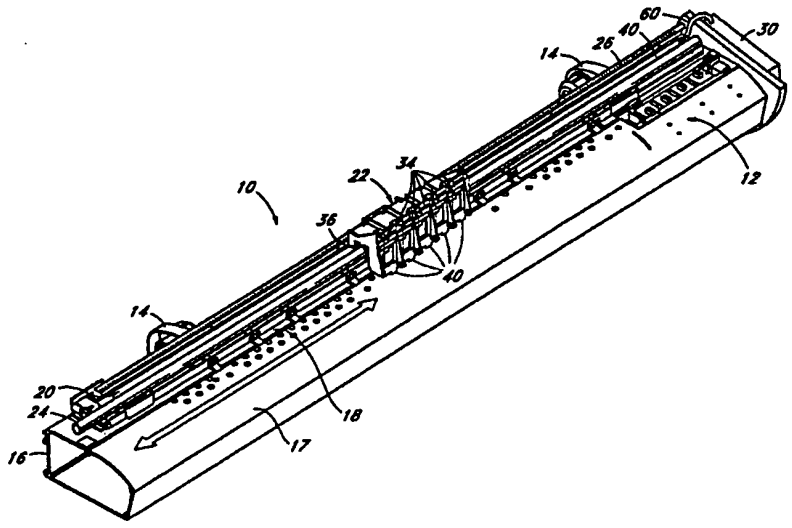
(81) Designated States: AL, AM, AT, AU, AZ, BB, BG, BR, BY, CA, CH, CN, CZ, DE, DK, EE, ES, FI, GB, GE, HU, IS, JP, KE, KG, KP, KR, KZ, LK, LR, LS, LT, LU, LV, MD, MG, MK, MN, MW, MX, NO, NZ, PL, PT, RO, RU, SD, SE, SG, SI, SK, TJ, TM, TR, TT, UA, UG, UZ, VN, ARIPO patent (KE, LS, MW, SD, SZ, UG), Eurasian patent (AM, AZ, BY, KG, KZ, MD, RU, TJ, TM), European patent (AT, BE, CH, DE, DK, ES, FI, FR, GB, GR, IE, IT, LU, MC, NL, PT, SE), OAPI patent (BF, BJ, CF, CG, CI, CM, GA, GN, ML, MR, NE, SN, TD, TG).

Published
With international search report.

(54) Title: INKJET PRINTER WITH MULTIPLE COLOR PRINT HEADS



(57) Abstract

An inkjet printer which increases the number of print colors avaialable from the basic four CMYK colors without significantly increasing the cost of the printer. The inkjet printer can include five colors, the four basic CMYK colors and a fifth specialized color. The inkjet printer can also include six or seven colors, the four basic CMYK colors and two or three additional colors. The specialized color can be a user determined color, such as a color unique to a corporation, such as IBM blue or Coca-Cola red. The specialized color(s) can also be colors which are useful in creating flesh tone colors, such as orange or green. In the seven color embodiment, it is possible to utilize both the CMYK process colors and the RGB process colors to increase the gamut of color options available. Advantageously, these additional colors are added to a traditional CMYK inkjet printer without reducing the printing speed or the print quality and without adding any substantial complexity to the printer.

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INKJET-PRINTER WITH MULTIPLE COLOR PRINT HEADS

Background of the Invention

The invention relates to inkjet printers. In particular, the invention relates to increasing the number of print colors available in an inkjet printer.

Color inkjet printers of the prior art utilize four basic colored inks to form all of the necessary color variations required in printing. The four basic colors are cyan, yellow, magenta and black and the printing process which utilize these four colors is called the CMYK process, where C is for cyan, Y is for yellow, M is for magenta and K is for black. In an ink jet printer, the CMYK colors are not actually blended together to form the desired color, instead, very small drops of ink of different colors are deposited next to each other on the page. From a slight distance, the human eye tends to blend the individual ink drops together to form an area of the "mixed" color. Using the proximal deposition of color, color ink jet printers are generally able to reproduce a sufficient number of colors using the CMYK process which are satisfactory to the general population.

Color ink jet printers are often used for graphics arts applications. In the graphic arts, it is often desirable to use a wider palate of colors than are necessarily used by the general population. For example, flesh tone colors are often used in graphic arts when a picture of a person is being reproduced. Flesh tone colors are not easily created using the CMYK color method, because more subtle shading and colors are required to produce flesh tones than can be produced using cyan, magenta, yellow and black. Another example of colors that are used in graphic arts applications are fluorescent colors and metallic colors. Neither fluorescent colors, nor metallic colors, can be formed using the CMYK process.

Other specialized colors can not be easily formed by mixing these four CMYK colors. One example of a specialized color that can not easily be formed by the CMYK process is a corporate color. A corporate color is a color, such as IBM Blue or Coca-Cola Red, that is designed to be distinctive and unique to the corporation. These unique corporate colors are generally formed at the molecular level and are made up by bending a variety of tints, hues and shades of colors in order to achieve a unique color. Due to the complexity involved in forming a unique corporate color, such colors are not easily duplicated using the four basic colors of the CMYK process.

When CMYK inkjet printers try to achieve some of these specialized colors, too many ink droplets of the CMYK colors must be placed proximal to each other in a very constrained space to even attempt to achieve the specialized color. The dense placement of so many ink drops in close proximity often result in over-inking of the paper. When over-inking occurs, the individual ink droplets do not have a sufficient amount of time to dry before a proximal drop of ink is placed adjacent the wet drop which results in bleeding of the ink. The ink bleeding results in visible bleed lines in the graphic image which is undesirable. In addition, there are often slight variations in the CMYK ink lots, so even if a specialized color of ink is achievable at one time, it may not be achievable at a later time, if ink of a different lot is used.

Prior inkjet printers have not been able to achieve specialized colors beyond the CMYK colors, because it is difficult to implement systems other than traditional CMYK printers in a cost effective manner.

Summary of the Invention

The present invention is an inkjet printer which increases the number of print colors available from the basic four CMYK colors. In one embodiment, the inkjet printer includes five colors, the four basic CMYK colors and a fifth added or specialized color. In another embodiment, the inkjet printer includes six colors, the four basic CMYK colors and two added specialized colors.

In one embodiment, the specialized color is a user-specified custom color such as a corporate color. A corporate color is a color, such as IBM Blue or Coca-Cola Red, that is designed to be distinctive and unique to the corporation. A corporate color is typically used for logos and other designs which the user wishes to be formed of their unique and distinctive color.

In another embodiment, the specialized color that is added by the user is a color or colors which are useful in producing flesh tones. These flesh tone colors are desirable for graphic arts applications which typically involve reproducing pictures of people. In one embodiment, the added color is orange. In another embodiment, the added color is green. In still another embodiment, both green and orange are added to the traditional CMYK colors. The green and orange colors can be juxtaposed with the traditional CMYK colors and are capable of producing truer flesh tone colors.

In a further embodiment, the specialized color is a metallic or fluorescent color. Metallic and fluorescent colors are also colors which are desirable for graphic arts applications and which are not readily achievable using the CMYK color process.

A significant feature of the inkjet printer of the present invention is that additional ink colors are made available without reducing the overall print speed and print quality of the inkjet printer. Additionally, the preferred embodiment of the inkjet printer of the present invention is a low cost, easy to manufacture printer with increased color capabilities over the printers of the prior art and without adding any substantial complexity to the printer which provides several significant advantages.

Brief Description of the Drawings

Figure 1 is a perspective view of an inkjet printer which includes five different print colors.

Figure 2 is a top plan view of an inkjet printer carriage which is adapted to operate with five inkjet cartridges.

Figure 3 is a perspective view of an inkjet printer carriage which is adapted to operate with five inkjet cartridges.

Figure 4 is an exploded perspective view of a traditional four stall printer carriage in cooperation with an added carriage stall to accommodate a fifth inkjet cartridge.

Figure 5 is an exploded perspective view of a five stall printer carriage in cooperation with an added carriage stall to accommodate a sixth inkjet cartridge.

Figure 6 is a schematic diagram of the data flow circuitry which translates the data from the main printer electronics to data for each inkjet cartridge.

Figure 7 is a schematic diagram of the inkjet control circuitry of Figure 6.

Figure 8 is a schematic diagram of the inkjet data control circuitry for inkjet cartridge head #1.

Detailed Description of the Preferred Embodiment

The multi-color inkjet printer of the present invention is advantageously implemented without greatly increasing the complexity of the printer while adding additional color capabilities beyond the traditional CMYK process colors. In addition, the multi-color ink jet printer of the present invention enables the creation of certain specialized colors without affecting the printing speed or the print quality of the inkjet printer.

The preferred embodiment of the multi-color ink jet printer is described in association with Figure 1. A printer carriage assembly 10 is supported on the top face of a printer housing 12, which is a part of a typical printer device. The housing 12 is supported by a stand (not shown) and encloses various electrical and mechanical components related to the operation of the printer/plotter device, but not directly pertinent to the present invention. As an exemplar of a printer device, the assignee of the present application sells a thermal ink jet printer device under the trade name of NovaJet III. An operations manual of the NovaJet III printer entitled "NovaJet III User's Guide" (ENCAD Part No. 202409) is hereby incorporated by reference. In order to minimize the complexity of the printer apparatus and maintain a low manufacturing cost, the printer of the present invention is advantageously very similar to the NovaJet III, with the exception of the modifications, as described in more detail below.

A pair of slidable roll holders 14 is mounted to a rear side 16 of the housing 12. A roll of continuous print media (not shown) can be mounted on the roll holders 14 to enable a continuous supply of paper to be provided to the printer/plotter carriage assembly 10. Otherwise, individual sheets of paper may be fed into the rear side 16 of the housing as needed. A portion of a top side 17 of the housing 12 forms a platen 18 upon which the printing/plotting is performed by select deposition of ink droplets on to the paper. The paper is guided from the rear side 16 of the housing 10 under a support structure 20 and across the platen 18 by a plurality of drive rollers 19 which are spaced along the platen 18.

The support structure 20 is mounted to the top side 17 of the housing 12 with sufficient clearance between the platen 18 and the support structure 20 along a central portion of the platen 18 to enable a sheet of paper which is to be printed on to pass between the platen 18 and the support structure 20. The support structure 20 supports a print carriage 22 above the platen 18. The support structure 20 comprises a guide rod 24 and a coded strip support member 26 positioned parallel to the longitudinal axis of the housing 12.

The print carriage 22 supports a plurality of printer cartridge holders also referred to as cartridge receiving channels 34 each with a respective printer cartridge 40a, 40b, 40c, 40d and 40e removably mounted therein. The print cartridges are preferably fifty-six nozzle 20440X series print cartridges available from ENCAD, Inc. of San Diego, California. In the preferred embodiment, the print carriage 22 includes five printer cartridge holders 34. The print carriage 22 includes two split sleeves 36 which partially surrounds and slidably engage the guide rod 24 to support the print carriage 22 for linear movement of the carriage 22 along the guide rod 24 as shown by the bi-directional arrow in Figure 1. A motor (not shown) and drive belt mechanism 40 are used to drive the print carriage 22 along the guide rod 24. The operation of the print carriage 22 and the printer cartridges 40a-40e is controlled by the main

printer electronics or print engine 30 which is contained in the printer housing 12. The main printer electronics 30 is connected to the circuitry on the print carriage 22 by a trailing cable 66.

Focusing on one embodiment of the print carriage 22 constructed in accordance with the invention, as illustrated in Figures 2 and 3, the moveable print carriage 22 supports five inkjet cartridges 40a-40e. The print carriage 22 is a single piece molded part made from a polycarbonate material reinforced with 10% glass and 10% carbon fiber using a traditional injection molding process. Advantageously, the print carriage 22 is formed such that the five printer cartridge holders 34 are staggered to enable the five inkjet cartridges 40a-40e to be mounted within a small space. Thus, the preferred embodiment of the print carriage 22 is a staggered five stall design which enables the control and operation of five inkjet cartridges 40a-40e.

An alternative embodiment of the invention is shown in Figure 4. A four stall inkjet printer carriage 42 similar to the prior art CMYK printer is illustrated in combination with an additional inkjet carriage adapter 44a which provides an additional receiving channel 34a or stall to accommodate a fifth inkjet cartridge (not shown). The four stall printer carriage 42 advantageously includes two mounting pins 46a, 48a and a mounting hole 50a on one end 54 of the four stall printer carriage 42. Preferably, the mounting pins 46a, 48a are molded as part of the four stall printer carriage 42 when the printer carriage 42 is manufactured. The additional inkjet carriage adapter 44a includes three corresponding mounting holes 56a-60a, two holes 56a and 58a are aligned with the mounting pins 46a and 48a on the four stall printer carriage 42. A third hole 60a is aligned with the mounting hole 50a on the print carriage 42. Additionally, the inkjet carriage adapter 44a includes an access hole 63a in-line with the third hole 60a which enables a screw to access the third hole 50a. A single screw assembly 62a is placed thorough the access hole 63a and the third hole 60a on the inkjet carriage adapter 44a and then through the mounting hole 50a on the print carriage 42 to permanently attach the adapter 44a to the printer carriage 42.

Figure 5 illustrates another embodiment of five stall printer carriage 22 in cooperation with an additional inkjet carriage adapter 44b which provides an additional receiving channel 34b to accommodate a sixth inkjet cartridge (not shown). The five stall inkjet adapter 44b is similar to the four stall inkjet adapter 44a except that the stagger of the added sixth receiving channels 34b of the five stall adapter 44b is more offset than the stagger of the fifth receiving channel 34a in order to enable proper staggered alignment of the added fifth and sixth print heads. In one embodiment, the five stall printer carriage 42 advantageously includes two mounting pins 46b, 48b and a mounting hole 50b on one end 61 of the five stall printer carriage 22. Preferably, the mounting pins 46b, 48b are molded as part of the five stall printer carriage 22 when the printer carriage 22 is manufactured. The inkjet carriage adapter 44b includes three corresponding mounting holes 56b-60b. Two holes 56b and 58b are aligned with the mounting pins 46b and 48b on the five stall printer carriage 22. The third hole 60b is aligned with the mounting hole 50b on the print carriage 22. Additionally, the five inkjet carriage adapter 44b includes an access hole 63b in-line with the third hole 60b which enables a screw to access the third hole 50b. A single screw assembly 62b is placed thorough the access hole 63b and the third hole 60b on the inkjet carriage adapter 44b and then through the mounting hole 50b on the print carriage 22 to permanently attach the five stall adapter 44b to the five stall

printer carriage 22. The additional inkjet carriage adapter 44 can be added to any size print carriage to add additional receiving channels 34 to add additional inkjet cartridges.

Figure 6 is a schematic diagram of the data flow circuitry 64 on the printer carriage 22 which translates the data from the main printer electronics 30 (Figure 1) to data for each of five print cartridges 40a-40e (Figure 1). The image data is converted to print data and control signals by the main printer electronics (print engine) 30 in the printer housing 12 using a process similar to that used in the NovaJet III printer. The print data and control signals are sent from the main printer electronics 30 to the printer carriage 22 via a trailing cable 66. Data lines (HA0-HA3) 68 transfer the print data and some of the print control signals in a serial fashion. Additional print control signals are each send along their own data lines. For example, the shifting or clocking signal (SHIFT) on the line 70 synchronizes the data sent to the inkjet cartridges 40 to the data sent from the main printer electronics. The head strobe signal (HSTB), an active low signal, on the line 72 initiates the firing of the jets on the inkjet printer cartridge 40. The data flow circuitry 64 routes the data and control signals which are received at the printer carriage 22 to each of the inkjet cartridge heads #1-5. In addition, the data flow circuitry 64 receives the control signals in serial from the main printer electronics and translates them into control signals for each of the inkjet cartridge heads 40 using the inkjet control circuitry 74 which is described in more detail below in association with Figure 7. data

As well known in the inkjet printer art, a typical inkjet cartridge 40 is divided into four quadrants of control. Thus data for each inkjet cartridge 40 is sent in four individual packets, one for each quadrant of the inkjet cartridge 40. Each of the four quadrants of the inkjet cartridge 40 therefore receives its own print control signal to control the firing of the jets in that particular quadrant of the inkjet cartridge 40. As an example, a five cartridge inkjet printer, constructed in accordance with this invention, will receive twenty print control signals, one for each quadrant of the five cartridges 40.

These twenty print control signals are translated from the serial data received from the main printer electronics into the individual control signals by the inkjet control circuity 74 as illustrated in Figure 7. The inkjet control circuitry 74 preferably includes a plurality of cascaded sets of four flip-flops. In the preferred embodiment, the ink jet control circuitry 76 includes five stages 76-84 of four flip-flops per stage. The control signals on the lines HA0-HA3 68 are clocked into the first stage of four flip-flops 76 via the clock signal SHIFT on the line 70. At the appearance of the next clock signal SHIFT on the line 70, the data from the first stage 76 of flip-flops is clocked into the second stage 78 of flip-flops and new control signals on the lines HA0-HA3 are clocked in the first stage 76 of flip-flops. This process continues along all five stages 76-84 of the flip-flop cascade, with the new control signals pushing the old control signals into the next stage of flip-flops, until the control signals reach the fifth and final stage 80 of flip-flops. After the control signals reach the fifth and final stage 80 of the flip-flop cascade, the next set of control signals pushes the control signals out of the fifth stage 80 and those control signals are lost.

As the control signals are clocked into the next stage of flip-flops, the control signals are also available on the output of each stage of the flip-flops. The outputs of each set of flip-flops are each ANDed together with the head strobe signal HSTB on the line 72 which when active indicates that the data at the outputs of the flip-flop

are valid. In the preferred embodiment of Figure 6, the outputs of each of the flip-flips of the stages 76-84 are sent to one input of a two-input NAND gates 85. In addition, the head strobe signal HSTB is sent to a second inverted input of the two-input NAND gates 85. Thus when the head strobe signal HSTB, an active low signal, on the line 72 is active, the outputs of each stage of the flip-flop are valid and forms the select signals SEL0-SEL19 on the lines 86 for each of the quadrants of the inkjet cartridges 40. Referring back to Figure 6, the select signals SEL0-SEL19 on the lines 86 are immediately sent to each of the inkjet cartridge heads 1-5 with four of the select lines going to each of the heads 1-5 to control the operation of the jet nozzles in each of the four quadrants of the head.

Referring to Figure 8, the inkjet data control circuitry 88 for inkjet cartridge head #1 is shown. The inkjet control circuitry 88 for each head is typically identical, therefore the inkjet data circuitry 88 for inkjet cartridge head #1 is considered exemplary for the circuitry for the other cartridge heads #2-#5. The inkjet control circuitry 88 for head #1 is connected to the data flow circuitry 64 of Figure 6 via the connector 90, as illustrated on Figures 6 and 8. The inkjet control circuitry 88 includes a jet drive circuit 92 for each of the four quadrants of the inkjet cartridge head 40. As well known in the inkjet printer art, before the control signals are sent over the lines HA0-HA3 68, the jet data for the nozzles in the each of the quadrants are sent over the lines HA0-HA3 68. The HA0-HA3 lines 68 are also demultiplexed in the jet drive circuitry 92 to select one of the jets in a quadrant. One of the SEL0-SEL19 signals on the lines 86 enables the demultiplexer in each quadrant. The outputs of the demultiplexer are used as data signals for each of the nozzles in the inkjet cartridge as known to those of skill in the art. Also as known to those in the art, the jet data signal is boosted to the level required to fire the nozzles of the inkjet cartridge 40 by drivers in the jet drive circuitry 92. After the valid jet data is received and converted for firing the nozzles in the inkjet cartridge 40, the HSTB signal on the line 72 is initiated. The initiation of the HSTB signal on the line 72 indicates that the jet data is ready and that the control signals for each quadrant of the inkjet cartridges are valid, thus creating the select signals SEL0-SEL19 86 of Figures 6-7. Four of these valid select signals are transferred to each of the cartridge heads 40. When the jet data and the quadrant control or select signals SEL3-SEL0 are valid for head#1, the nozzles which are indicated by the jet data as printing in the selected quadrant of the inkjet cartridge, as controlled by the select signals SEL3-SEL0, are activated and the ink is deposited on the print media.

Advantageously, the quadrant control signals and the jet data can be transmitted very quickly in this serial fashion. In addition, due to the high clock speeds which are achievable, the serial data can be rapidly translated into parallel data for use by the inkjet cartridge heads. Using the currently available clock speeds and transmission media, the control electronics of the inkjet printer of the present invention can advantageously transmit data to five or six inkjet cartridges without causing a noticeable decrease in the printing speed over the four cartridge inkjet printers of the prior art. Thus, the serial transmission of the inkjet control signals enables the addition of additional inkjet cartridges without degrading the speed of the overall printing process.

The addition of the supplemental inkjet cartridges enables the addition of other ink colors to the traditional CMYK print colors typically used in multi-color print applications. The additional color may be a user-specified custom color such as a corporate color. A corporate color is a color, such as IBM Blue or Coca-Cola Red, that is designed

to be distinctive and unique to the corporation. A corporate color is typically used for logos and other designs which the user wishes to be formed of their unique and distinctive color.

In another embodiment, the additional color that is added by the user is a color or colors which are useful in producing flesh tones. These flesh tone colors are desirable for graphic arts applications which typically involve reproducing pictures of people. In one embodiment, the added color is orange. In another embodiment, the added color is green. In still another embodiment, both green and orange are added to the traditional CMYK colors. The green and orange colors can be juxtaposed with the traditional CMYK colors and are capable of producing truer flesh tone colors.

In a further embodiment, the added color is a metallic or fluorescent color. Metallic and fluorescent colors are also colors which are desirable for graphic arts applications and which are not readily achievable using the CMYK color process.

In anther embodiment, the additional receiving channel can be used to hold an inkjet cartridge containing an additional quantity of one of the CMYK colors which is frequently used in printing. For example, if the printer typically uses twice as much magenta as the other CMYK colors, the printer can be equipped with one cyan, one yellow, one black and two magenta cartridges. In this example, the printer is equipped with one primary magenta cartridge and one backup magenta cartridge. The backup magenta cartridge is used as a reserve tank of ink when the primary cartridge runs out of ink. Preferably, the printer only uses prints with either the primary or the backup print cartridge at one time.

As the printing commences, the print engine 30 keeps track of how many drops of ink the primary cartridge has printed. When the count approaches a predetermined limit, the print engine determines that the primary cartridge is close to empty. On the next printing pass, the print engine halts printing with the primary cartridge and switches to the backup cartridge and continues printing without interruption. This backup cartridge can be advantageously used for print jobs having a large quantity of one color of ink while using a typical quantity of the remaining colors of ink to enable the printer to continuously print without requiring continual cartridge changes of the frequently used color.

In still another embodiment, the printer carriage 22 is modified to accept seven inkjet cartridges. Preferably, in the seven cartridge embodiment, four of the cartridges are used for the traditional CMYK colors and the other three are used for the traditional RGB colors where R is for red, G is for green and B is for blue or violet. In the seven color embodiment, the gamut of colors that can be produced by combining the CMYK and RGB colors is greatly increased over those colors producible only by either the CMYK colors or the RGB colors alone.

The present invention provides a significant improvement over the prior art without substantially increasing the complexity of the printer apparatus and/or adversely affecting its printing speed. Thus, an alternative system conceived by the inventor for overcoming this problem of the prior art was to improve the custom and flesh tone colors by reducing the drop size of the ink. By decreasing the size of the ink drops which are placed proximal to each other, an improved color resolution can be formed which will provide a truer color "blend" at closer ranges for these difficult to produce colors. Another disadvantage of this option is that decreasing the drop size of the ink

slows down the speed of the printer. Since the drop size is fixed, it is not possible to reduce the drop size of the ink for certain color applications while increasing the drop size for general printing purposes. Thus, it would not be advantageous to decrease the drop size to provide a better resolution of one color while the printing of all of the other colors on the page are also slowed down. Therefore, this alternative system and method lacks a way to provide specialized color applications for a basic inkjet printer without reducing the printing speed. In addition, this alternative system and method would not enable the addition of fluorescent colors at any ink drop size, as fluorescent colors are not readily reproducible using the CMYK process colors.

The present invention adds room for additional color(s) beyond the traditional CMYK colors in the printing process without reducing the speed of the printing process and without causing a reduction in print quality over the four color CMYK printers of the prior art. Additionally, the preferred embodiment of the inkjet printer of the present invention does not add any substantial complexity to the printer while provides several significant advantages over a typical four color inkjet printer of the prior art.

In addition, by implementing a simple design which utilizes the serial transmission of data at high speeds, the printer of the present invention is implemented in a manner which enables the printer to be manufactured at a low cost.

Further, the mounting of the additional print head(s) to the print carriage can be formed as a single molded part which also keeps the manufacturing cost of the printer low. Alternatively, the additional print head(s) can be added onto a traditional four stall inkjet carriage utilizing a simplified mounting procedure which does not increases the costs by a significant amount and enables the addition of additional color features to the inkjet printer.

The present invention may be embodied in other specific forms without departing from its spirit or essential characteristics. The described embodiments are to be considered in all respects only as illustrative and not restrictive. The scope of the invention is, therefore, indicated by the appended claims rather than the foregoing description. All changes which come within the meaning and range of equivalency of the claims are to be embraced within their scope.

WHAT IS CLAIMED IS:

1. An inkjet printer which provides for a repeatable accurate rendition of a specialized color in addition to those colors achievable using the CMYK process and achieving extremely accurate color resolution without sacrificing either (i) the speed of the printer or (ii) overall print resolution while avoiding over-inking of the paper or other media being printed, said inkjet printer comprising:

main printer electronics capable of controlling the printer operation;

a printer carriage housing at least five inkjet cartridges, said printer carriage capable of controlling each of said at least five inkjet cartridges; and

data flow circuitry receiving data in a sequential format from said main printer electronics and translating said sequential data for each of said five inkjet cartridges.

2. The inkjet printer of Claim 1 wherein the data flow circuitry is resident on said printer carriage.

3. An inkjet printer which provides for a repeatable accurate rendition of a specialized color in addition to those colors achievable using the CMYK process and achieving extremely accurate color resolution without sacrificing either (i) the speed of the printer or (ii) overall print resolution while avoiding over-inking of the paper or other media being printed, said inkjet printer comprising:

a printer carriage comprising at least five staggered inkjet cartridge receiving channels, each of said five staggered ink jet receiving channels being capable of routing control signals to an inkjet cartridge; and

at least five inkjet cartridges, each of said inkjet cartridges containing a different color of ink, wherein each of said ink jet cartridges is received in one of said at least five inkjet cartridges receiving channels on said printer carriage.

4. An inkjet printer which provides for a repeatable accurate rendition of a specialized color in addition to those colors achievable using the CMYK process and achieving extremely accurate color resolution without sacrificing (i) the speed of the printer, (ii) overall print resolution while avoiding over-inking of the paper or other media being printed, or (iii) the ability to use conventional ink jet cartridges, said ink jet printer comprising:

a movable printer carriage mounted for translation across the media to be printed;

a plurality of inkjet cartridge receiving receptacles carried by said moveable printer carriage, the number of said receptacles being greater than needed for the CMYK process; and

a plurality of conventional ink jet cartridges respectively removably supported in said receptacles, said cartridges providing the respective colors for the CMYK process and one or more additional cartridges providing said specialized color.

5. The ink jet printer of Claim 4 wherein said specialized color is a corporate color.

6. The ink jet printer of Claim 4 wherein said specialized color enhances the printing of flesh tone.

7. The ink jet printer of Claim 4 wherein said specialized color is a fluorescent color.

8. The ink jet printer of Claim 4 wherein said specialized color is a metallic color.

9. A multi-color ink jet printer including (i) a printer housing and (2) printer electronics capable of controlling the printer operation including proving control signals to said inkjet cartridges for controlling the printing of the cartridges, said multi-color inkjet printer comprising:

a printer carriage comprising at least five staggered inkjet cartridge receiving channels, said printer carriage being capable of routing control signals to an inkjet cartridge; and

at least five inkjet cartridges, each of said inkjet cartridges containing a different color of ink, wherein each of said ink jet cartridges is received in one of said at least five inkjet cartridges receiving channels on said printer carriage.

10. The multi-color ink jet printer of Claim 9 wherein one of said at least five inkjet cartridges contains ink of a color which is capable of producing flesh tones.

11. The multi-color ink jet printer of Claim 10 wherein one of said at least five inkjet cartridges contains orange ink.

12. The multi-color ink jet printer of Claim 10 wherein one of said at least five inkjet cartridges contains green ink.

13. The multi-color ink jet printer of Claim 9 wherein one of said at least five inkjet cartridges contains a unique custom ink color.

14. A multi-color ink jet printer including (i) a printer housing and (2) printer electronics capable of controlling the printer operation including proving control signals to said inkjet cartridges for controlling the printing of the cartridges, said multi-color inkjet printer comprising:

a printer carriage comprising seven inkjet cartridge receiving channels; and

seven inkjet cartridges, each of said inkjet cartridges containing a different color of ink, wherein each of said ink jet cartridges is received in one of said at least five inkjet cartridges receiving channels on said printer carriage and wherein said printer carriage being capable of routing control signals to each of said inkjet cartridges.

15. The multi-color ink jet printer of Claim 14 wherein four of said seven inkjet cartridges contain ink of the CMYK process colors .

16. The multi-color ink jet printer of Claim 15 wherein the other three of said seven inkjet cartridges contain ink of the RGB process colors.

17. A multi-color ink jet printer including (i) a printer housing and (2) printer electronics capable of controlling the printer operation including proving control signals to said inkjet cartridges for controlling the printing of the cartridges, said multi-color inkjet printer comprising:

a printer carriage comprising a plurality of staggered inkjet cartridge receiving channels, said printer carriage being capable of delivering control signals to inkjet cartridges installed in said receiving channels; and

an inkjet carriage adapter coupled to said printer carriage to enable the addition of an additional staggered inkjet cartridge receiving channel being capable of delivering control signals to an inkjet cartridge.

18. A multi-color ink jet printer including (i) a printer housing and (2) printer electronics capable of controlling the printer operation including proving control signals to said inkjet cartridges for controlling the printing of the cartridges, said multi-color inkjet printer comprising:

a printer carriage comprising at least five cartridge receiving channels; and

at least five inkjet cartridges, wherein each of said ink jet cartridges is received in one of said at least five inkjet cartridges receiving channels on said printer carriage, said printer carriage being capable of routing control signals to each of said inkjet cartridges and wherein four of said inkjet cartridges each contains a different color of ink of the CMYK process colors and at least the fifth cartridge contains ink of a duplicate color of one of the CMYK process colors.

19. A method of providing a repeatable accurate rendition of a specialized color in addition to those colors achievable using the CMYK process and achieving extremely accurate color resolution without sacrificing (i) the speed of the printer, (ii) overall print resolution while avoiding over-inking of the paper or other media being printed, or (iii) the ability to use conventional ink jet cartridges, said method comprising the steps of:

translating a movable printer carriage across the media to be printed;

providing a plurality of inkjet cartridge receiving receptacles on said moveable printer carriage wherein the number of said receptacles is greater than needed for the CMYK process; and

removable supporting a plurality of conventional ink jet cartridges in said receptacles, said cartridges providing the respective colors for the CMYK process and one or more additional cartridges providing said specialized color.

20. A method of providing a repeatable accurate rendition of an image on an inkjet printer using the CMYK process colors wherein on of said CMYK colors is frequently used in reproducing said image, said method comprising the steps of:

translating a movable printer carriage across the media to be printed;

providing a plurality of inkjet cartridge receiving receptacles on said moveable printer carriage wherein the number of said receptacles is greater than needed for the CMYK process; and

removably supporting a plurality of conventional ink jet cartridges in said receptacles, said cartridges providing the respective colors for the CMYK process and one or more additional cartridges providing an additional quantity of ink for a frequently used CMYK process color.

21. The method of providing a repeatable accurate rendition of an image on an inkjet printer as described in Claim 20, additionally comprising the steps of:

maintaining a count of the drops of ink that has been printed by the inkjet cartridge containing the frequently used CMYK color ink;

halting the use of the inkjet cartridge containing the frequently used CMYK color ink when the count of drops has reached a predetermined limit; and

initiating the use of said one or more additional cartridges providing the additional quantity of ink for the frequently used CMYK process color.

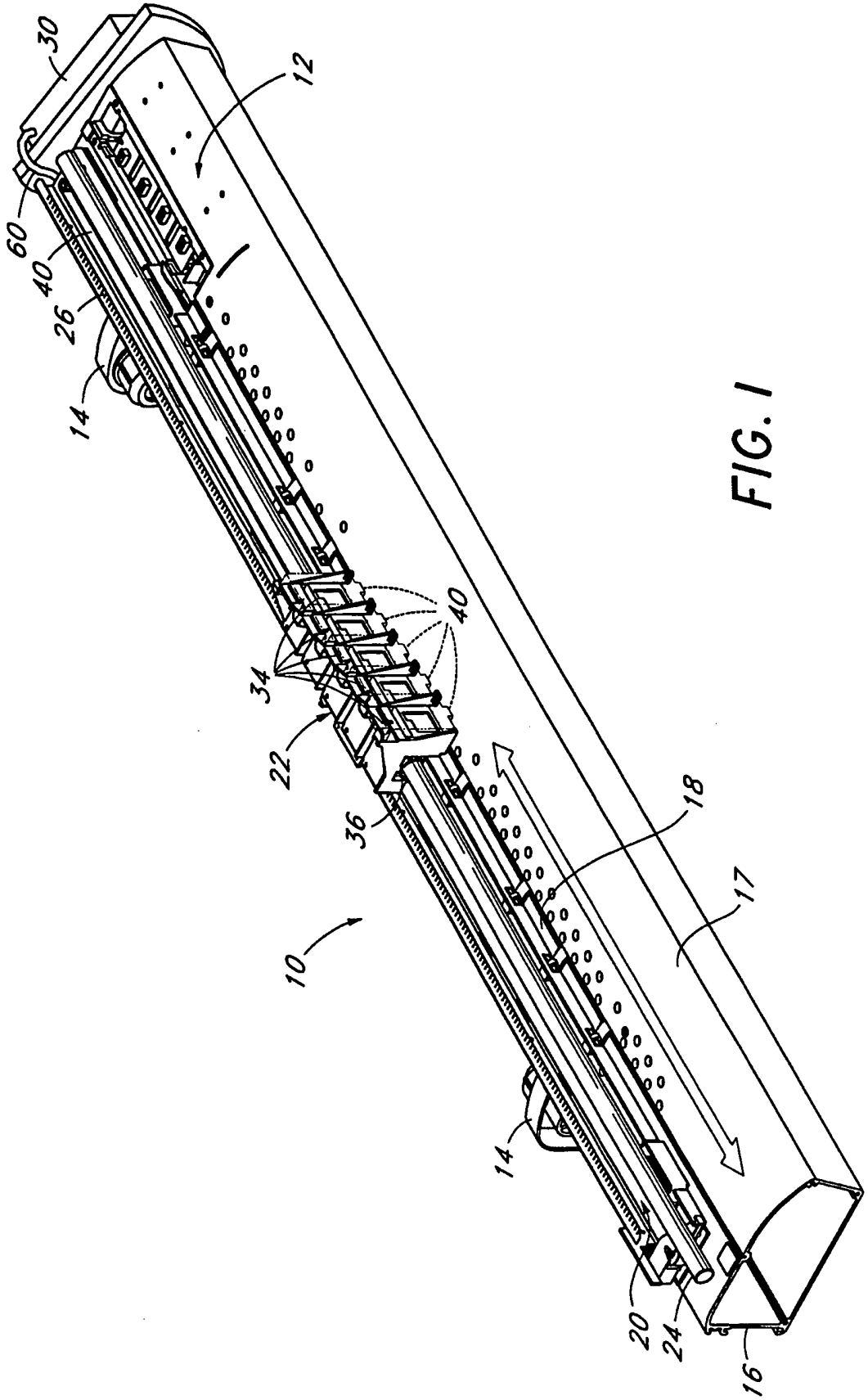
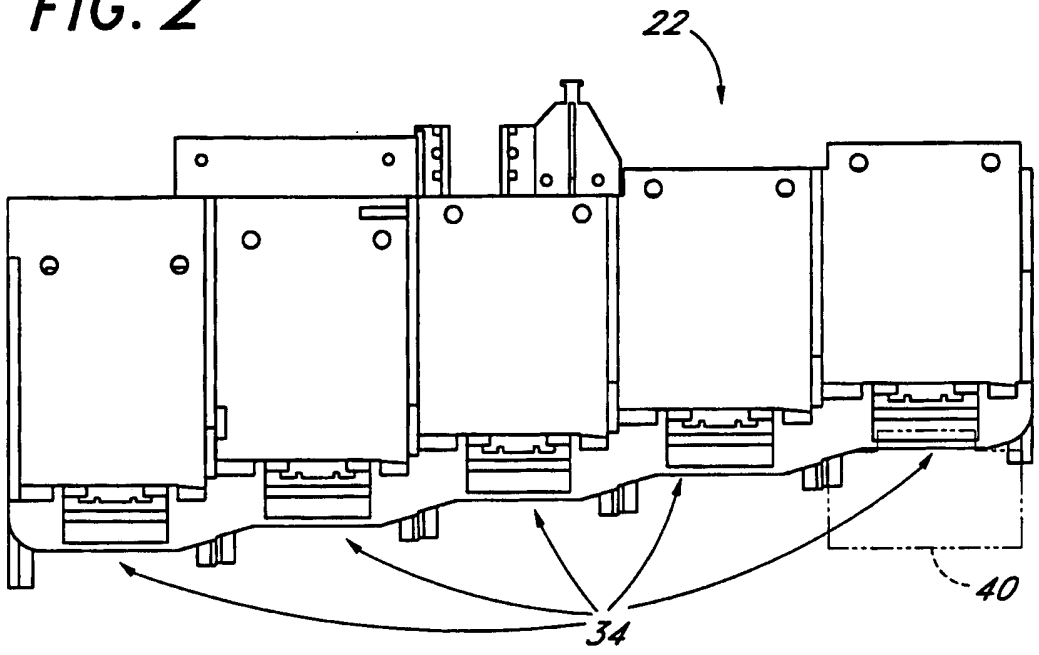


FIG. 1

FIG. 2



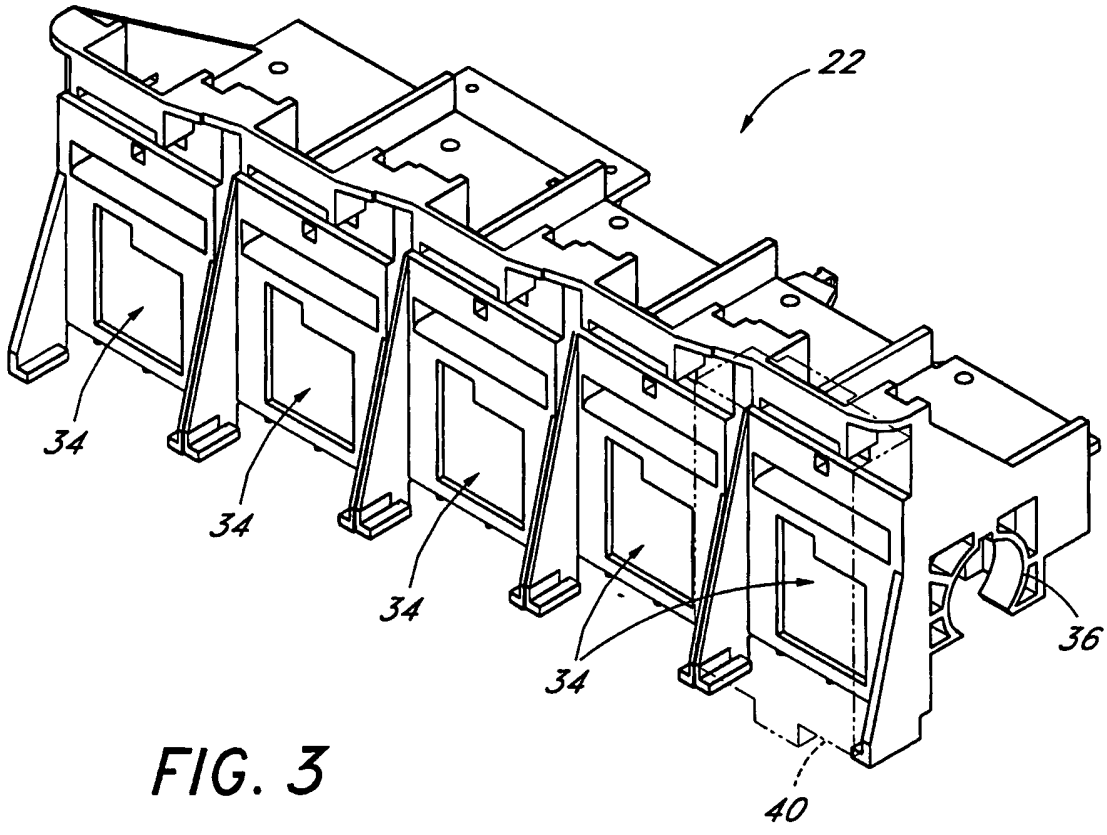


FIG. 3

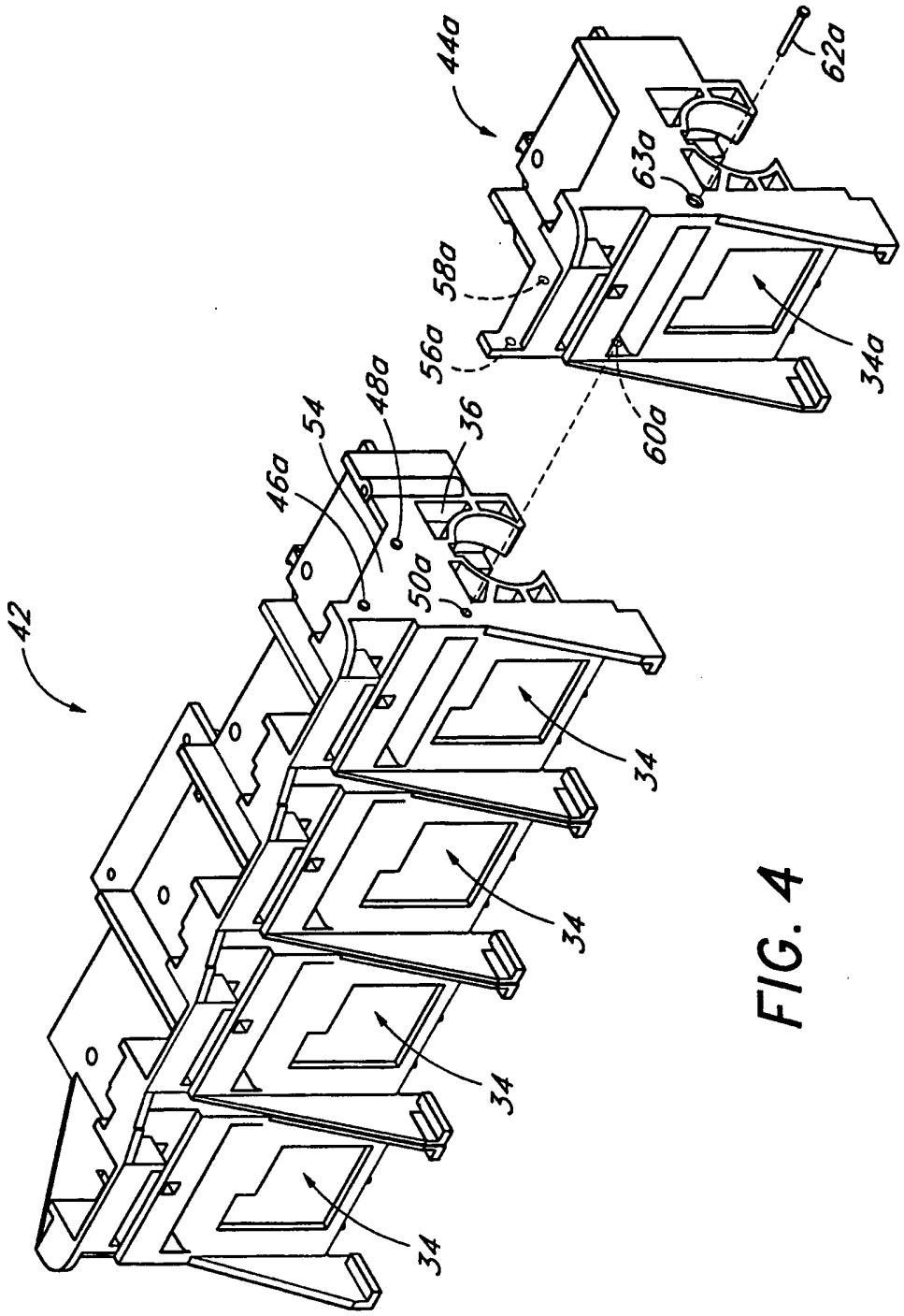


FIG. 4

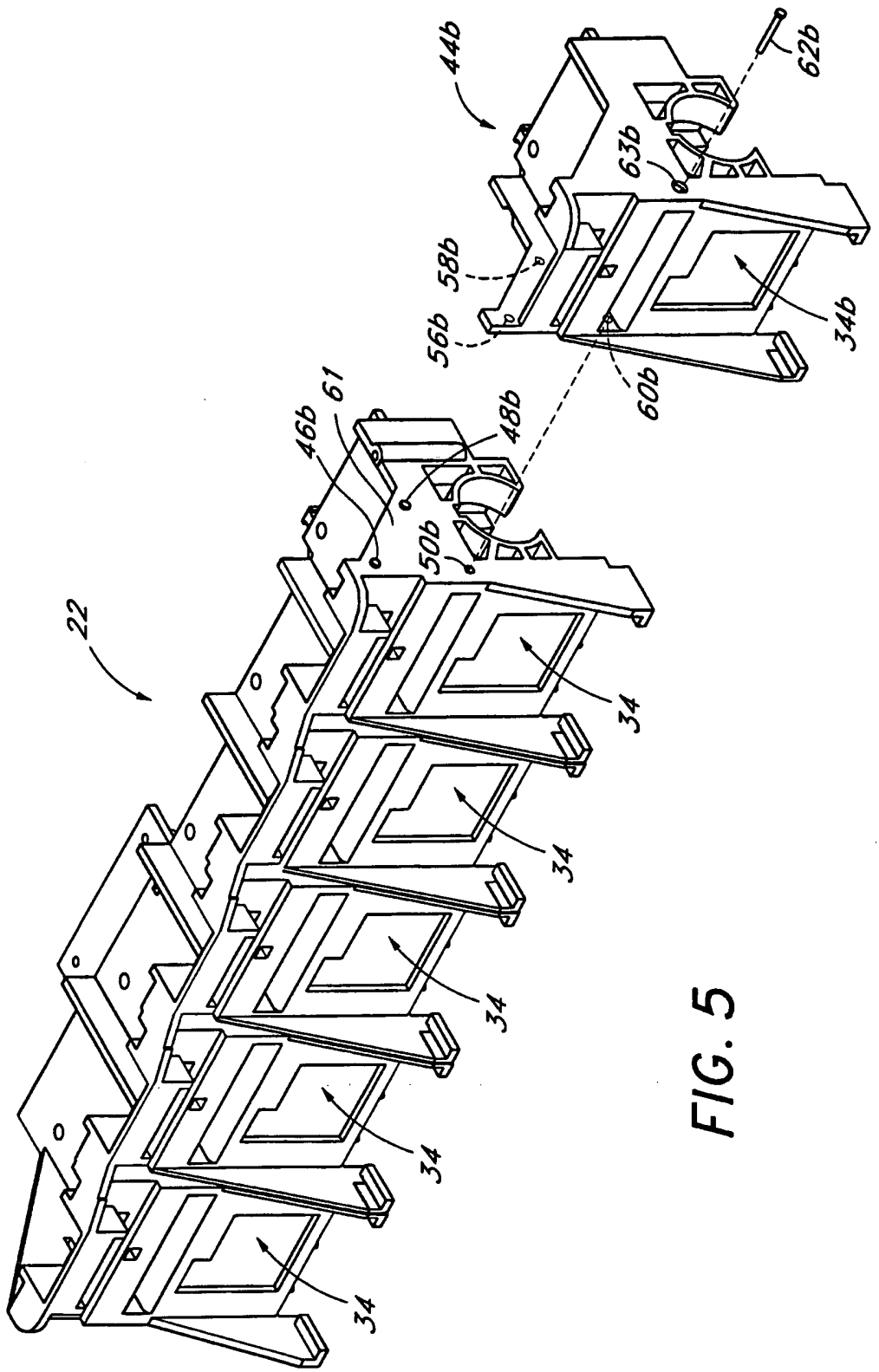
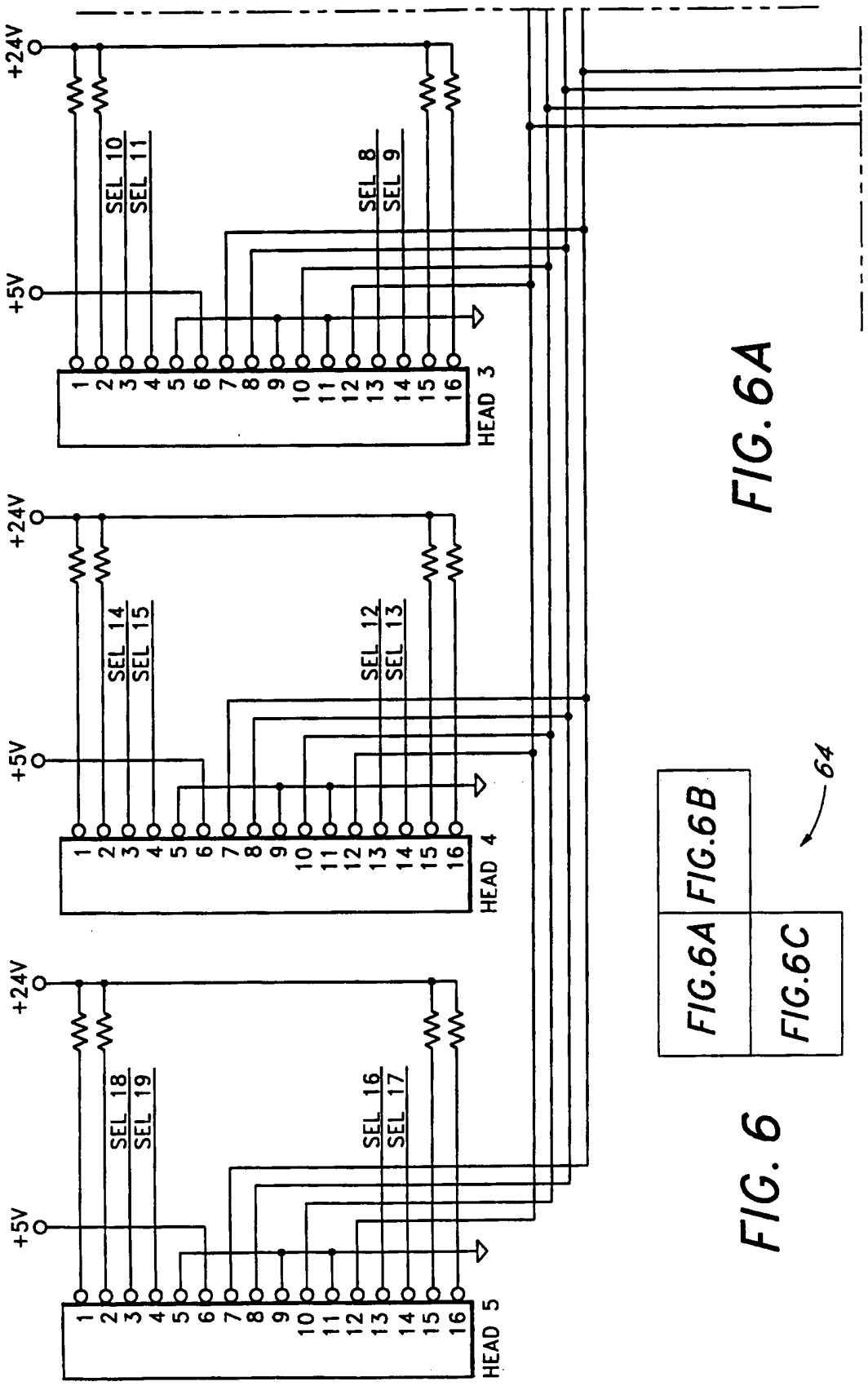


FIG. 5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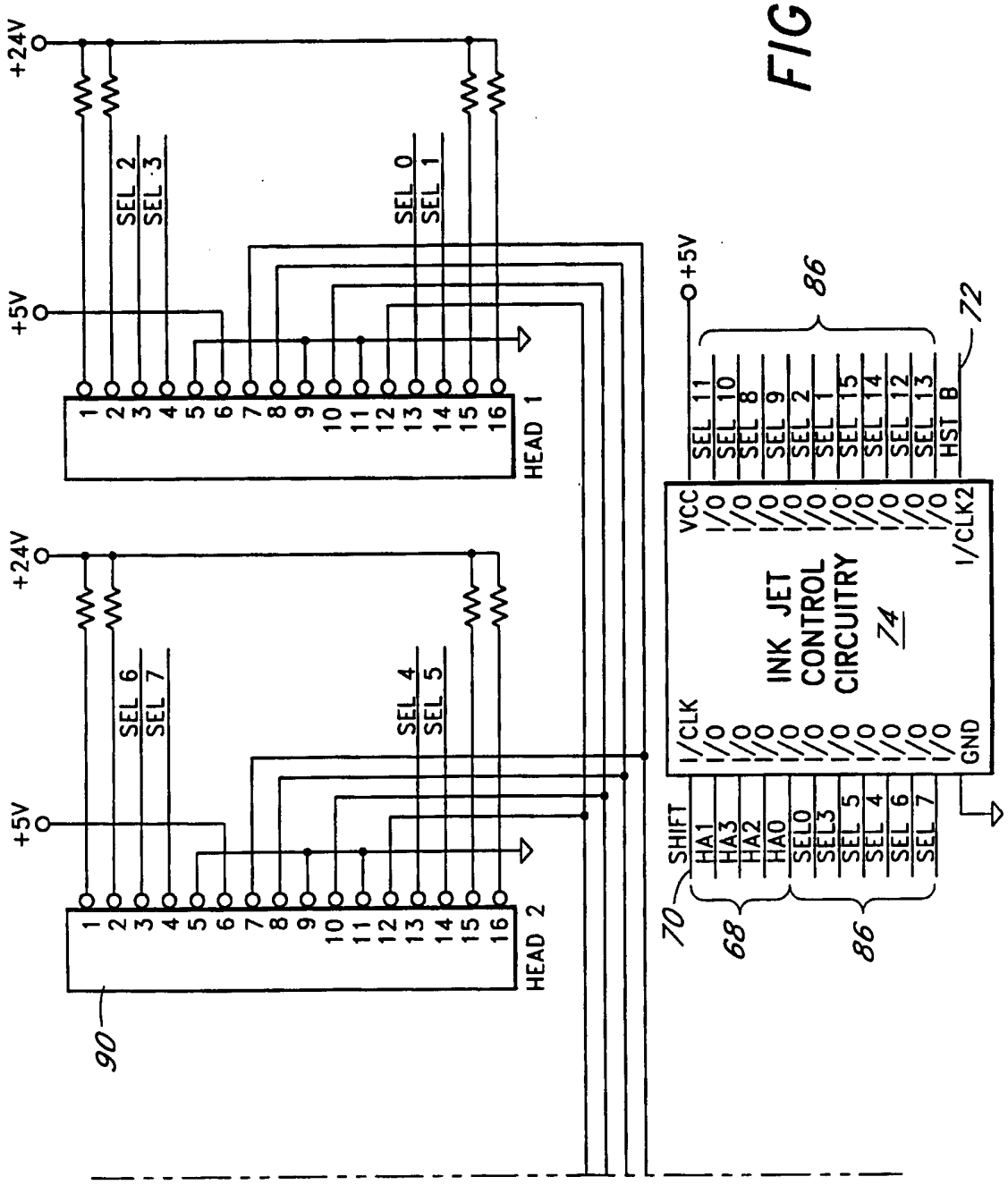
+5V
SEL 10
SEL 11
SEL 8
SEL 9
HEAD 3
SEL 14
SEL 15
SEL 12
SEL 13
HEAD 4
SEL 18
SEL 19
SEL 16
SEL 17
HEAD 5
1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16

FIG. 6A

FIG.6A
FIG.6B
FIG.6C
64

FIG. 6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SEL 4
SEL 5
HEAD 2
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+5V
86
72
SEL 11
SEL 10
SEL 8
SEL 9
SEL 2
SEL 1
SEL 15
SEL 14
SEL 12
SEL 13
HST B
VCC
I/O
I/CLK2
INK JET
CONTROL
CIRCUITRY
74
I/CLK
GND
SHIFT
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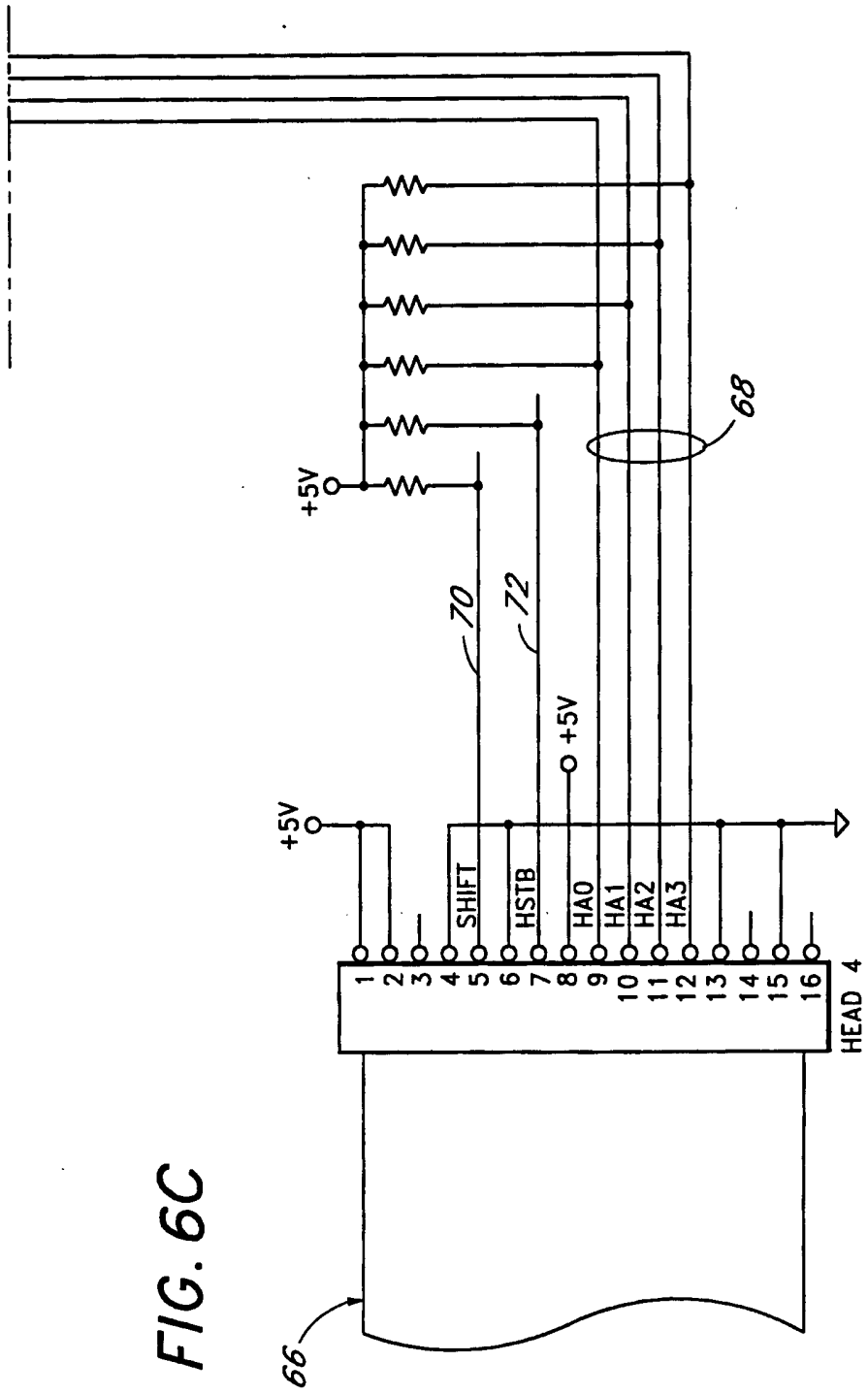
HA3
HA2
HA0
SEL0
SEL3
SEL 5
SEL 4
SEL 6
SEL 7
70
68
86

FIG. 6B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72
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SHIFT
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HA0
HA1
HA2
HA3
1
2
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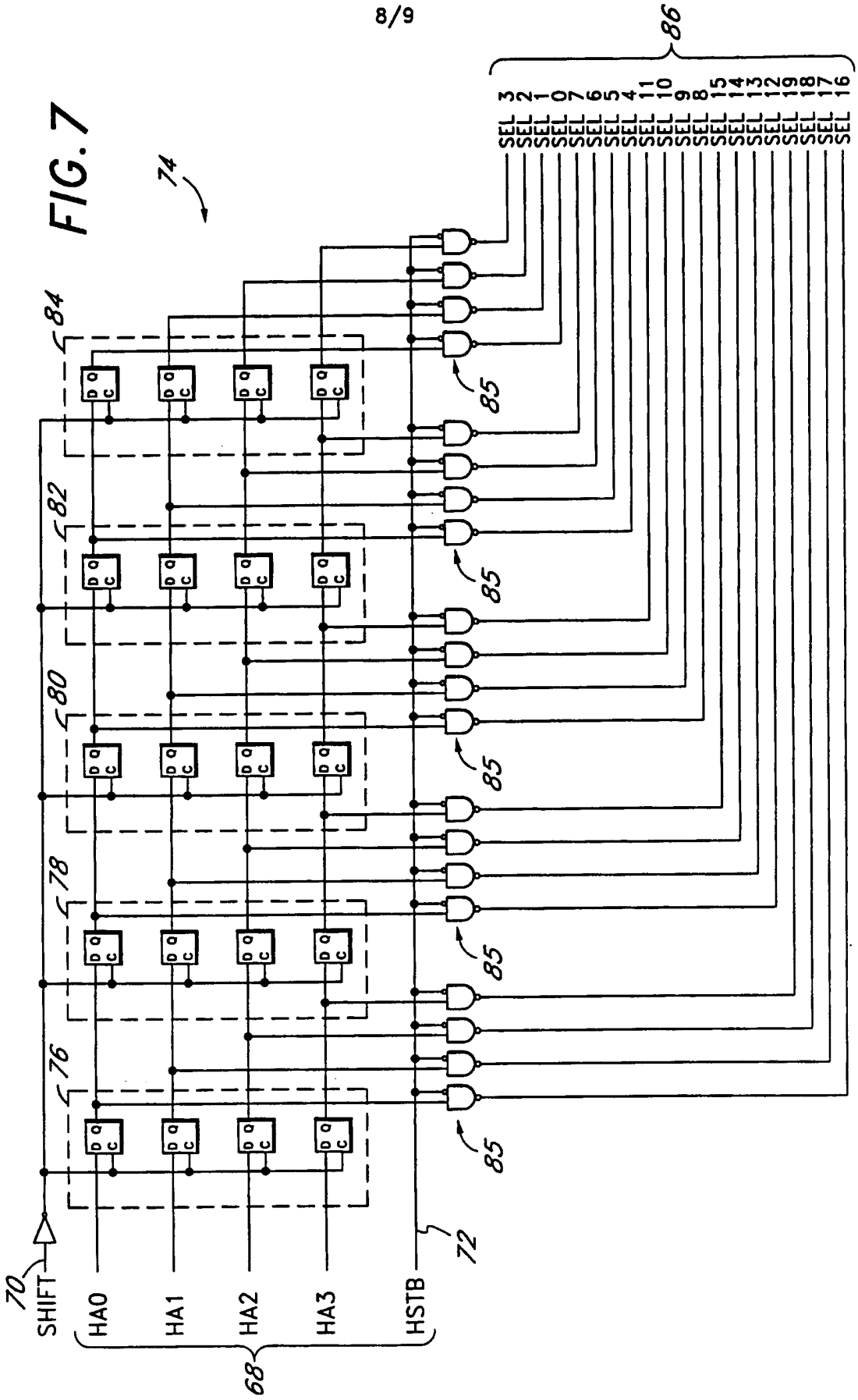
6
7
8
9
10
11
12
13
14
15
16
HEAD 4
66

FIG. 6C

FIG. 7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SEL 18
SEL 17
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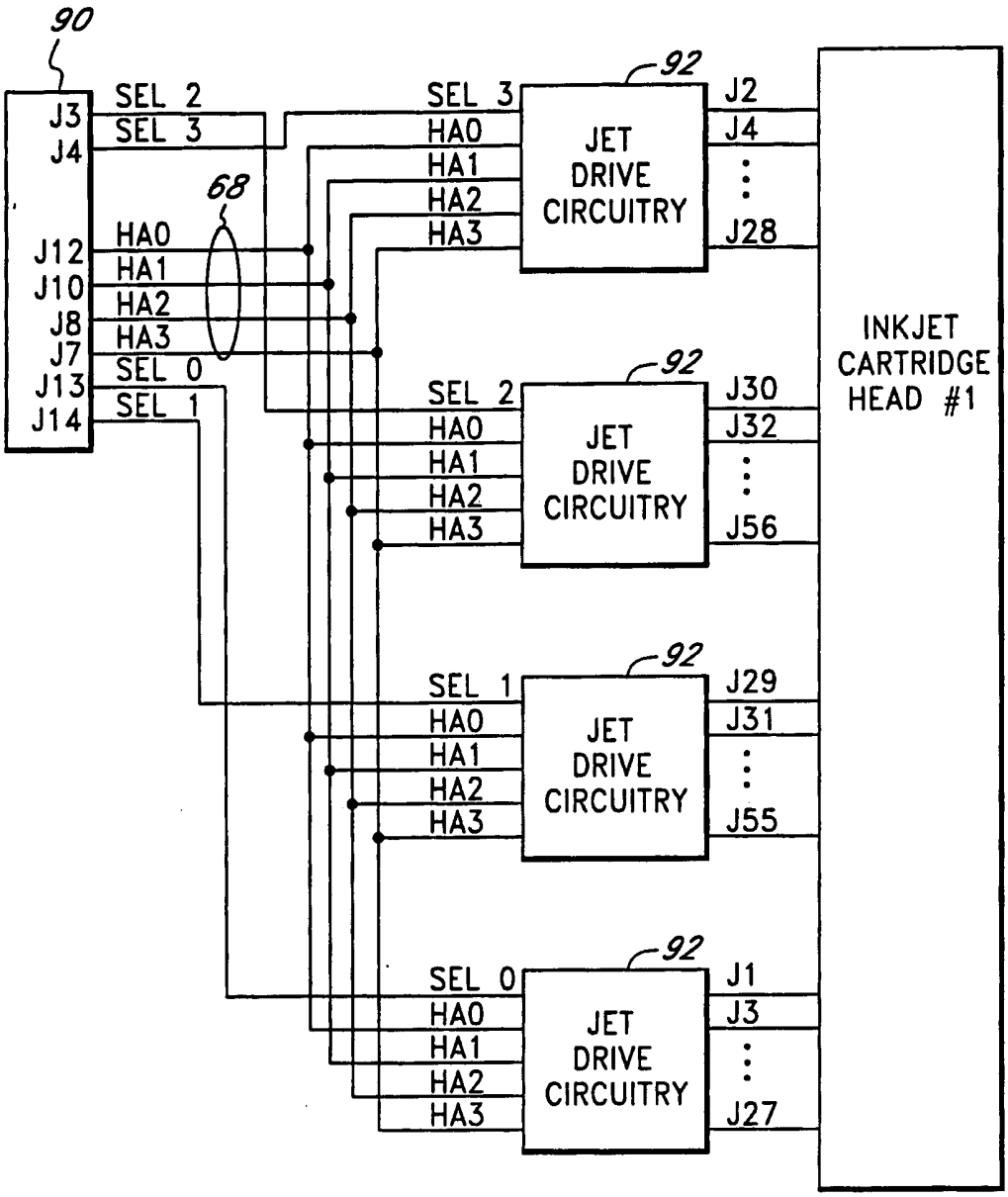
HA2
HA3
HSTB
68
72

FIG. 8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J14
SEL 2
SEL 3
HA0
HA1
HA2
HA3
SEL 0
SEL 1
68
92
JET DRIVE CIRCUITRY
J2
J4
J28
J30
J32
J56
J29
J31
J55
J1
J3
J27
INKJET CARTRIDGE HEAD #1

INTERNATIONAL SEARCH REPORT

In· ional Application No
PCT/US 96/06168

A. CLASSIFICATION OF SUBJECT MATTER
IPC 6 B41J2/21 B41J25/34 B41J2/05

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)
IPC 6 B41J

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practical, search terms used)

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category *	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X Y	EP,A,0 640 479 (CANON K.K.) 1 March 1995 see page 5, line 16 - page 10, line 16; figures 2,3	1,4,14, 18-20 2,3,9,17
Y	EP,A,0 568 175 (HEWLETT-PACKARD COMPANY) 3 November 1993 see column 3, line 13 - column 7, line 51; figures 1-5	3,9,17
Y	EP,A,0 500 939 (EREMIN) 2 September 1992 see column 6, line 2 - column 7, line 29	2,9,17
A	US,A,4 829 323 (SUZUKI ET AL.) 9 May 1989 see column 3, line 1 - column 5, line 30; figure 1	1-21

-/--

[X] Further documents are listed in the continuation of box C.

[X] Patent family members are listed in annex.

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"&" document member of the same patent family

Date of the actual completion of the international search	Date of mailing of the international search report
5 August 1996	21.08.96

Name and mailing address of the ISA	Authorized officer
European Patent Office, P.B. 5818 Patentlaan 2 NL - 2280 HV Rijswijk Tel. (+31-70) 340-2040, Tx. 31 651 epo nl, Fax (+31-70) 340-3016	De Groot, R

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INTERNATIONAL SEARCH REPORT

Int onal Application No
PCT/US 96/06168

C.(Continuation) D CUMENTS CONSIDERED TO BE RELEVANT

Category *	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	EP,A,0 581 297 (CANON K.K.) 2 February 1994 see column 12, line 50 - column 24, line 5; figures 7,29 -----	9

1

INTERNATIONAL SEARCH REPORT

Information on patent family members

In' ional Application No
PCT/US 96/06168

Patent document cited in search report	Publication date	Patent family member(s)		Publication date
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		CN-A-	1104584	05-07-95
EP-A-568175	03-11-93	US-A-	5376958	27-12-94
		JP-A-	6155772	03-06-94
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		JP-T-	5502827	20-05-93
		WO-A-	9119956	26-12-91
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